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ABSTRACT

This study investigated the use of computer mediated communication (CMC) to increase the cognitive level of student discourse by allowing students to reflect on difficult concepts on an as needed basis. The role of electronic mail (e-mail) interaction in producing a positive group feeling and closer personal relationships is also examined. Field theory, which considers components of group interaction based on spatial factors, systems of tension and field forces, was the basis by which the dynamics and productivity of the group was analyzed. The target population for the study consists of 17 adults enrolled in a course at Pennsylvania State University in the spring of 1994. Students were encouraged during regular class meetings to participate and discuss issues via e-mail. Two questionnaires were administered to students. The first, administered early in the semester, gathered data concerning hardware, software, existing personal relationships, personal data, biographical data, type of e-mail communication package, access to computers, types of computer available, location of access, problems with access, and spatial relationships. The second, administered at the end of the semester, gathered data concerning current spatial relations, systems of tension and field forces. During the 15 weeks of the course, 178 messages were generated. These were evaluated as falling into categories of cognitive activity. Eighty-four percent of the students felt that the CMC caused them to move in a positive direction in both the personal and cognitive areas; however, requiring students to discuss topical issues after class using e-mail is an insufficient situation for increasing critical thinking skills and affecting the group dynamic. (Contains 8 references.) (AEF)

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Title:

Raising the Level of the Debate: The Effects of Computer Mediated Communication on Group Dynamics and Critical Thinking Skills

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Introduction

The typical class in almost every educational situation (K-12 as well as most graduate education) is measured in terms of contact time i.e. the time the teacher is interfacing with the students. Computer Mediated Communication involves the use of the computer to initiate and respond to issues via an e-mail software application in conjunction with a network connection. The advantage of this communication modality is that participants can be and usually are separated by space and time. This means that student questions and concerns about erudite concepts recently encountered during study or reflection of class discussions can be addressed while the issue is fresh in the student's mind.

Computer Mediated Communication (CMC) can increase contact time as well as provide an opportunity for the student to address issues to the teacher and his/her peers after the concept, issue or problem is presented. CMC also enables the student to practice developing their own communication styles using the instructors as consultant/advisors (Philips and Santoro, 1989). Perhaps the most powerful advantage of CMC is that it provides the opportunity for students and faculty to clarify concepts. The use of CMC in a course provides for discursive feedback stripped of all the roles, gestures, body language, and other nonverbal forms of interaction that color meaning. In addition, CMC allows the students to see, reflect, ruminate, refute and structure the CMC discussion points. It makes the discussion tangible by making it visual. Small conceptual nuances can be missed in discussions infused with social and personal contexts. Viewing the argument makes the concept concrete for student review with CMC.

Finally, CMC allows tracking of the concept discussions in a historical or chronological fashion. This can also be a disadvantage as communications are received in a chronological order and a student signing on to e-mail tends to respond to the questions in the order they are received. If a student does not stay current on a daily basis with the communications he/she may find themselves well behind in the discussion. The student needs to be engaged in the activity. Scardamalia and Bereiter termed this engagement "intentionality" and has identified it as an important variable in the use of Computer Mediated Communication (Scardamalia, M., & Bereiter, C. 1989). This engagement or "intentionality" is, of course, important for all learning.

Factors

Factors that facilitate the use of Computer Mediated Communication in decision making situations are well established. McLeod states that computer mediated communication systems typically increase decision quality, time needed to make a decision, equality of participation, and degree of task focus. However, studies also show that CMC in decision making decreases consensus and satisfaction (McLeod, 1992). These same factors are important in the learning situation. The frequency of participation in small groups is, however, related to the social context, group composition, role of the leader, norm regarding student participation and the goal of the meeting (Stephen & Mishler, 1952). No studies currently address the issues of the level of the debate or the effect of computer mediated communication on the group interaction. Issues of quality of interaction and contribution are more related to group feeling. The major premise of this study is that having students engage in computer mediated communication will increase the cognitive level of student discourse by allowing students to reflect on difficult concepts on an as needed basis. In addition, this e-mail interaction will produce a positive group feeling and movement of the class toward closer personal relationships. Lewin identified several factors which impact on the group dynamic and can be applied to the analysis of CMC interactions. He elaborated these dynamics as "field theory."

Field theory considers components of group interaction based on several factors. These factors include spatial factors, systems of tension and field forces. Spatial factors are geometric adaptations of space of free movement, both physically and intellectually. The second class of concepts is anchored in dynamic psychology of the individual (e.g., need, aspiration level, satiation). These latter concepts for the most part refer to systems of tension within the person himself. Pressures within the individual and pressures emanating from the surrounding field are termed field forces (motives clearly depending upon group pressures) barriers (obstacles to individual action owing to group restraints), or locomotion (changing of the individuals position with reference to the group) (Allport in Lewin, 48). Lewin suggests that the group dynamics are controlled by the balance between these forces. By extension, analyzing the group for these perspectives will aid in understanding both the dynamics and productivity of the group. This study is primarily based on these factors.

Field Theory

Field theory is a conceptual framework for modeling the "psychological forces" influencing individuals at any given instant.(Diamond, 92). According to Lewin (1942) there are six attributes of field theory that are particularly important:

1. The use of a constructive method
2. A dynamic approach
3. An emphasis upon psychological Processes
4. Analysis based upon the situation as a whole
5. A distinction between systematic and historical issues
6. A mathematical representation of psychological situations.

Lewin used these attributes to analyze and describe group dynamics in many situations. A short discussion of these attributes follows.

In the constructive approach elements are grouped according to their relationships. The elements we will consider are "life space", "field forces" and "tension systems"(figure 1). The life space of an individual consists of the person and the psychological environment that exists for him or her. Behavior according to Maruyama(1992) is a function of that person and that person' environment. According to Shaw(1982), it is the totality of all psychological factors that influence the individual at any given moment. In a similar manner, the life space of a group consists of the group and the environment as it exists for the group at the time. Therefore the behavior of any individual or group is a function of the person/group and the person/group environment. Individual life space is differentiated into regions and dependent on unique variables of the individual. It has two additional dimensions.

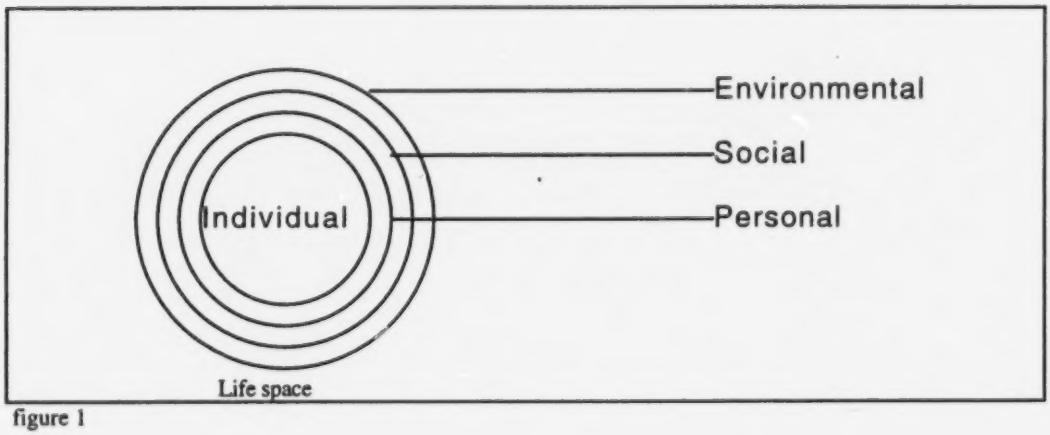

figure 1

The first is the fluidity of the system which is the degree to which regions are distinguishable from each other and its reality/irreality characteristic. If the boundaries are rigid and very different then fluidity or ease of movement from on region to the next is limited. This tends to force choice.

The second is the level of irreality which involves imagery and fantasy, whereas the level of reality involves more objective aspects of the life space. The level of reality in the psychological future corresponds to what is expected, whereas, the level of irreality corresponds to the fears for the future. Dynamically, the level of irreality is more fluid and more closely related to the central layers of the personality that the level of reality(Shaw, 1982).

Behavior is identified as the movement or locomotion of the person in life space. There are different types of locomotion: include bodily locomotion, or approach or avoiding goals(psychological locomotion). Locomotion, according to Shaw, may be produced by a need, which corresponds to a tension system in the inner-personal region. The extent to which the need will produce locomotion depends in part on the degree to which the inner-personal region is in communication with another region, where two regions are said to be in communication if a change of state in one region produces a change of state in the other region. If two regions are in communication and a need is aroused in one of the regions, locomotion from that region to the second occurs until a state of equilibrium is reached, that is, until the opposing forces in the two regions are equal in strength.(Shaw, 1982)

A force is defined as that which causes change (Lewin, 1936). Its properties are strength, direction, and point of application. Thus for any given point in the life space, the construct force represents the direction of and tendency to change. A number of forces can act on the same point at any given time, and the combination of these forces is called the resultant force. This is the effective force operating to determine behavior. When the resultant force is greater than zero, there is either a locomotion in the direction of that force or a change in the cognitive structure that is equivalent to locomotion. Conversely, if a locomotion or change in structure occurs, resultant forces exist in the direction of that change (Lewin, 1946). The strength of force toward or away from a goal is a function of the strength or the valence and the psychological distance between the person and the goal.

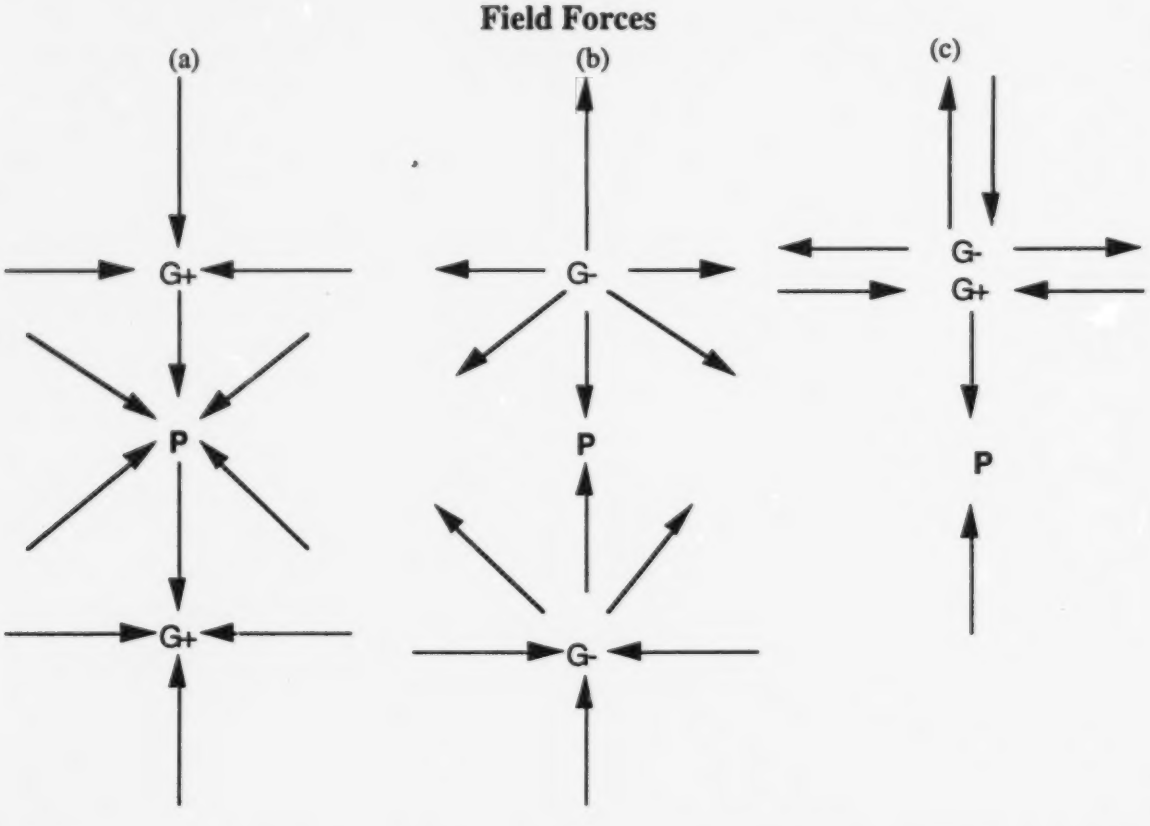

Figure 2 (a) A force field corresponding to two positive valences: (b) a force field corresponding to two negative valences: (c) a force field corresponding to a positive and a negative valence in the same direction.(Shaw, 82)

Lewin identified several types of forces: driving forces, restraining forces, induced forces, forces corresponding to one's own needs, and impersonal forces. Forces toward a positive or away from a negative valence are called driving forces because they lead to locomotion (figure 2). However, locomotion may be hindered or prevented by physical or social obstacles or barriers. Such obstacles are called restraining forces. They do not lead to locomotion but they do exert an influence on the effects of driving forces (Lewin, 1946).

In any life space tensions exist. When the strength of one set of tensions is stronger than another, movement or locomotion from or toward that region may be instigated. This locomotion results in change. When regions are highly permeable (i.e. no rigid boundaries between regions) the change can be systematic across several regions. These concepts will be used to interpret the dynamics observed in the study.

Each student has their own life space and interacts with other student's life space in class with all the social trappings. As a student, each is in a competitive environment with others in the class. A goal of the class is construct a similar mental model of the subject matter in each student. This is traditionally done through lecture, assigned readings and classroom discussion. The idea is to get the student to move cognitively toward this mental model by reducing the barriers to that movement. By stripping away the social environment and reducing the language/speaking barrier using CMC it is assumed that the student will be freer to make that cognitive movement towards the mental model i.e. making one set of tensions stronger than the other. In addition, the time to reflection will result in the student creating a realistic argument for a particular set of beliefs as they develop their conceptual model. Therefore, the student will tend more toward evaluating the concept in their discussion than just summarizing others thoughts.

Methodology

The target population for the research consists of seventeen adults enrolled in a course entitled, "Designing Cognitive Learning Environments" at The Pennsylvania State University in the spring of 1994. The goal of the proposed project was to research the effect of computer mediated communication on group dynamics according to "field theory."

Discussing class concepts via e-mail was a stated requirement of the course. Students were encouraged during regular class meetings to participate and discuss issues via e-mail. Interesting discussions were continued during the regular weekly class meetings. Two communication packages were available to the students. Pop-mail which provided a word processing type interface and PSUVM which provided more of a command line type interface. The choice of communication packages was left up to the student as was getting an access account.

Two questionnaires were administered to students. The first questionnaire, early in the semester, gathered data concerning hardware, software, existing personal relationships, personal data, biographical data, type of e-mail communication package, access to computers, types of computer available, location of access, problems with access, and spatial relationships. The second questionnaire administered at the end of the course gathered data concerning current spatial relations, systems of tension and field forces. All class communications were saved. A protocol was developed to analyze the communication in terms of the level of interaction, direction of interaction, and communication relationships. Electronic mail communication was analyzed in terms of criteria adapted from the cognitive activity levels as discussed by Jonassen in Mindtools (Jonassen, 94).

Jonassen identified nine cognitive activity levels. These levels are evaluating, analyzing, connecting, elaborating, synthesizing, imagining, designing, problem solving and decision making. These terms are defined by Jonassen as follows:

Evaluating	assessing information, determining criteria, prioritizing, recognizing fallacies, verifying
Analyzing	recognizing patterns, classifying, identifying assumptions, identifying main ideas, finding sequences
Connecting	comparing/contrasting, logical thinking, inferring deductively, inferring inductively, identifying casual relationships
Elaborating	expanding, modifying, extending, shifting categories, concretizing
Synthesizing	analogical thinking, summarizing, hypothesizing, planning
Imagining	fluency, predicting speculating, visualizing, intuition.
Designing	imagining a goal, formulating a goal, inventing a product, assessing a product, revising a product.
Problem solving	sensing the problem, researching the problem, formulating the problem, finding alternatives, choosing the solution, building acceptance
Decision making	identifying an issue generating alternatives, assessing the consequences, making as choice, evaluating the choices.

Since the purpose of the study is to identify higher levels of cognitive activity due to reflection the categories of problem solving and decision making were discarded as irrelevant to the study.

Analysis

A questionnaire was given to the students participating in the class. The questionnaire was administered at the last class meeting. The data collected included the following:

- The quality of interaction each student had with their classmates at the beginning of the semester and the quality of the interaction at the end.
- Experience using the listserve.
- The perceived effects the conferencing had on student learning.
- The perceived effectiveness of the experience in facilitating learning.
- The frequency of signing onto the listserve.
- What the student did with the messages they received.
- Did they read the messages on-line?
- Self ranking on a Introvert Extrovert scale.
- Self ranking on reflective or active learning style.

In addition, class electronic communications were collected by listing out all the communications on the listserve. These were organized according to level of interaction and communication pattern(i.e.. who was involved in the discussion)..Data collected from the questionnaire were entered into a database along with the abstract rankings of the messages and frequency of interaction. Correlational analyses were conducted.

Discussion

During the fifteen weeks of the course 178 messages were generated for discussion by the students. Seven separate themes were discussed in the context of "constructivism". The length of the messages varied as did the complexity. The messages were sorted by the major theme. These were then evaluated by several independent evaluators as falling into one of the categories of cognitive activity as outlined by Jonassen. Chatty messages that did not fall into any of the categories were labeled as Not Applicable. The message content was distributed as follows:

Evaluating	14
Analyzing	41
Connecting	30
Elaborating	17
Synthesizing	51
Imagining	09
Designing	02
Not Applicable	14

The discussion items tended to move up the rating scale as the student became an expert in dealing with the issues over time. This trend would seem to support the contention that the level of debate was rising throughout the term. However, it is not clear what role using CMC had in this trend.

The students overcame significant barriers to using the interface effectively. At least two different e-mail systems were available for students. These had very different user interfaces with one being difficult to use. The other was more forgiving and utilized the standard features of a word processor. Several students indicated that they had trouble getting on to the e-mail system from home and several could only read messages at the university. Other difficulties mentioned included:

- difficulty down loading messages to disk
- getting a hard copy of the messages
- jumping into the middle of a discussion to make a point when the conversation has moved beyond that point
- too many messages
- don't have enough time to read the messages

Students indicated that they felt that using CMC as an out of class activity enhanced information exchange and gave them time to reflect on the issues under discussion. They also stated that it gave them time to resolve issues prior to attending class. Students were also able to go back to their resources and reinforce the argument that they were making in class. It also gave them more concrete information about what other students were thinking about the subject. CMC argument were generally more organized and referenced than the oral arguments in class.

Most participants accessed their mail on a daily basis, but were more likely to respond to the discussions on the day of the class. This proved to be a disadvantage for some students as they may not have seen some of the discussion points before they arrived at class. An interesting side bar was that most of the participants did not read the messages on-line, but rather printed them out before reading them. So much for the cost savings in paper. Another interesting highlight was that some participants would create their responses in a word processing environment and transfer it to e-mail so that it would be spell checked prior to being sent.

Most students began the semester with few personal associations among the group and although some group work was required, most of this was accomplished via the computer. It was assumed that group dynamics and a feeling of personal closeness would be facilitated by CMC discussion of issues relevant to the participant. Spatial grouping indicated that students who participated in the electronic discussions ranked other participants as closer to them than the students who were less frequent participants. Students tended to elaborate the concepts from a personal perspective drawing upon prior knowledge more than doing extended readings to support their individual viewpoints. This tendency caused more advanced students to comment on a lack of depth to the CMC. Students who took an adversarial role in the CMC discussions tended to show less growth on the group dynamic scale. The spatial maps also indicated that several group

members were not engaged in the CMC discussions. These same students tended to be less likely to participate in class. Discussion initiators tended to be the least experienced in the content area. Those more familiar with the content tended to contribute by connecting the issues and clarifying discussion points rather than initiating the discussions.. Students with language difficulties(English as a second language, ESL) tended to participate at a higher cognitive level using CMC than in class, but still tended to be among the least frequent users.

At the onset CMC discussions messages were more likely to fall in the lower levels of cognitive activity scale of not applicable, designing, imagining and synthesizing, while later messages were in the connecting, analyzing and evaluating categories. This indicates that some raising of the debated did occur. This may be largely though the mentoring activity of the professor, who would respond to messages by making connections for specific discussion questions and not just a result of have the CMC function available to students. Barriers to communication were also reduced by the professor's frequent reinforcement to student communications. Conceptual movement for students involved in a topic was also evidenced by the quality of the communication change from lower to higher cognitive activity levels.

Conclusion

Eighty-four percent of the students felt that the CMC caused them to move in a positive direction in the both the personal and cognitive areas. However, requiring students to discuss topical issues after class using e-mail as a CMC device is an insufficient situation for increasing critical thinking skills and affecting the group dynamic. The number of variables affecting student behavior are numerous and overcoming barriers to personal and mental growth must be addressed in a more systematic way. Some barriers to movement included: the CMC interface, time to read; time to formulate a response and address as many as twenty separate concepts in addition to all the other class responsibilities; and student individual differences. The CMC interface can be a considerable barrier to personal and cognitive movement.

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